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COUNTDOWN ACID RAIN

GOVERNMENT REVIEW OF THE ELEVENTH PROGRESS REPORTS

(JULY 31, 1991)

BY ONTARIO'S FOUR MAJOR SOURCES OF SULPHUR DIOXIDE

Ontario Ministry of the Environment

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INTRODUCTION

Four major corporate sources (Inco, Falconbridge, Algoma at Wawa, and Ontario Hydro) produce over 80% of Ontario's sulphur dioxide (SO_2) emissions. Each source is required by Ontario's Countdown Acid Rain regulations to report every six months on the progress made to reduce SO_2 emissions.

The Countdown program was formulated in 1985 and placed an annual SO_2 emissions cap of 885 kt (new limit 877 kt) on all sources in the province, to be in place by 1994. Specific reductions in SO_2 for the four companies began in 1986 and culminate in a cap totalling 665 kt by 1994. In the case of Ontario Hydro, limits were also placed on the combined emissions of SO_2 and nitric oxide (NO) and an interim cut of 35% limiting SO_2 to 240 kt and acid gases (SO_2 + NO) to 280 kt was also imposed for 1990-1993. The Countdown limits are in addition to standards imposed to ensure good ambient air quality. Annual legal limits are summarized in Table 1.

Table 1
Sulphur Dioxide Legal Limits
(thousands of tonnes per year)

	1985	1986	1990	1994
Inco nickel/copper smelter, Sudbury	728	685	685	265
Falconbridge nickel/copper smelter, Sudbury	154	154	154	100
Algoma iron ore sintering plant, Wawa	285	180	180	125
Ontario Hydro fossil fuel power plants, province-wide	390	370	240	175

Each of the four sources has met the legal limits to date and each has submitted detailed plans for implementing its reduction program, as required by the regulations. The sixth set of company progress reports, received in December 1988 and January 1989, set out the detailed methods and schedules for meeting the emission limits of the Countdown regulations. They were accepted by the government.

Implementation progress reports are required every six months. This document summarizes the contents of the eleventh set of semi-annual company reports and the government response. Previous semi-annual reports are available from the Public Affairs and Communications Services Branch, Ontario Ministry of the Environment, 135 St. Clair Avenue West, Toronto, Ontario, M4V 1P5, (416) 323-4321.

COMPANY REPORTS AND GOVERNMENT RESPONSES

The progress reports were reviewed by a technical work group drawn from the Ontario Ministries of Environment, Northern Development and Mines (for the metallurgical companies) and Energy (for Ontario Hydro).

The implementation phase of the Countdown program is now well under way, and each of the four regulated companies reports its progress and current status in relation to the 1994 emission limits. A summary of the individual reports, and the Ontario government's response follow.

INCO LIMITED

Regulation 660/85 requires a reduction in SO_2 emissions from Inco's nickel/copper smelter complex in Sudbury to no more than 265 kt for any year after 1993, compared to the current limit of 685 kt per year. The company was also required to examine the feasibility of going beyond the current limit of 265 kt by 1994 to a level of 175 kt at some future date. Consequently, the feasibility of continuing technical advances remain a concern of Inco and of the government. The government previously accepted Inco's position that a specific interim reduction was not feasible because of the nature of the major process changes being undertaken in order to meet the 1994 emission limit.

The company's eleventh progress report indicates that:

- Implementation of the Sulphur Dioxide Abatement Project is continuing as detailed in the report of December 1988 to meet annual SO_2 emissions target of 265 kt after 1993. The company's comprehensive long term recovery program was able to make-up a month out of the two months delay resulting from the labour disruptions of summer 1990. This has resulted in increased overall project costs.

- The mill's rationalization project is now complete but the scheduled start up date was delayed by 2 months due to difficulties in the completion and commissioning of semi-autogenous grinding (SAG) mill plant.

- The construction schedule shows that all planned work detailed in the company's 6th semi-annual report (December, 1988) will be completed by the third quarter of 1993.

- Financial commitments of about $490 million have been made. This is approximately 87% of the total estimated project cost.

- Expenditures to-date total some $390 million, about 65% of the revised project costs of $600 million.

- The overall engineering has progressed to 89% of completion and is according to schedule. The projected engineering curve shows that all engineering on Inco's SO_2 Abatement Program is expected to be finished by December, 1992.

- As of May 1991 some 215 engineering and construction management personnel were working on the project. In addition to this more than 1060 trade personnel were involved in on-site contract work.

- Inco has received necessary blanket Certificates of Approval (C of A) and the company has now provided additional information needed to issue final individual Cs of A.

- With the process changes being implemented in the copper smelting circuit, Inco is optimistic that fugitive SO_2 emissions from these operations will be significantly lower in 1994 than those at present.

The government review concluded that Inco continues to meet the requirements of Regulation 660/85. The Ministry has noted the company's concern regarding issuance of the final Certificates of Approval referred to in the company's report and would like to reassure Inco that the Ministry has assigned specific staff in its Approvals Branch to handle these applications appropriately. The MOE has sent six C of A's (2 final and 4 draft) to Inco. Some information is outstanding from the company and further discussions are required to complete individual Certificates of Approval.

- Inco's 1990 SO_2 emissions were 617.4 kt.

Some of the points of concern noted by the Countdown Technical Support Group (CTSG) are listed below:

- The Ministry would like to reiterate its request made to Inco in the Government Review of the Ninth Progress Reports by Ontario's Four Major Sources of Sulphur Dioxide (January 1991) to provide in future semi-annual progress reports simple process flowsheets and sulphur mass-balance diagrams.

- The Countdown Technical Support Group would like to see a revised implementation schedule of the company's SO_2 Abatement Program Project in future semi-annual progress reports.

Mill Rationalization

- The Ministry is pleased to know that the Mill Rationalization project is complete but the company should indicate in the 12th semi-annual progress report whether this project has met company objectives regarding concentrate throughput and grade and pyrrhotite removal efficiency.

Smelter

- Since a number of development programs and process plant commissionings (e.g., oxygen plant, the new acid plant, #2 flash furnace for bulk concentrate, MK flash converting) have occurred since May, 1991, the Ministry would like Inco to report developments in these areas in future progress reports.

SO_2 Emissions

- The Ministry wishes to be apprised of the aggregated new SO_2 ground level concentration levels based on estimated SO_2 emissions and dispersion characteristics from all stacks listed in Inco's earlier progress reports. Relevant computer programs to carry out the contaminant dispersion analysis study were provided by the Ministry to Inco several months ago. The Ministry is awaiting the results of this study.

- Inco's October 22, 1991 news release indicates that SO_2 emissions from the smelter are expected to be lower by 100 kt in 1992 than that of the current stipulated limit of 685 kt. The company should provide the basis of this estimate in its 12th semi-annual progress report.

Acid Plant

- The Technical Support Group noted that the existing IORP - sulphur products plant has been shut down since June 1991.

- The Ministry still has concerns about the periodic monitoring of sulphur trioxide concentration in acid plant tail gases and suggests that Inco review and possibly increase sulphur trioxide (SO_3) monitoring frequency using an automated analyser until a suitable continuous SO_3 monitor becomes available.

General Comments

- The Countdown Technical Support Group (CTSG) is planning to meet with the company officials and tour the mills, smelter and acid plant installations in the new year in order to review and to discuss the contents and format of the semi-annual progress report and possible impacts on the overall project schedule due to the economic slowdown.

FALCONBRIDGE LIMITED

Regulation 661/85 requires Falconbridge to reduce SO_2 emissions from its Sudbury nickel-copper smelter complex to no more than 100 kt for every year after 1993. The regulation also requires Falconbridge to evaluate the possibility of reducing SO_2 emissions below the 100 kt per year level. Promising areas for further reductions have been identified by the company.

The company's eleventh progress report, covering the period January to June 1991, notes that:

- The Company has now achieved operational capability in the smelter to meet the 1994 annual SO_2 emission limit of 100 kt at full smelter production capacity. These emission reduction achievements, at the design capacity of 88 million pounds of nickel per year were the result of process changes implemented by the company such as improved pyrrhotite rejection, increased degree of roasting and sulphuric acid production, enhanced slag cleaning operation, and increased smelting of recycled materials (custom feed).

- In the first six months of 1991 the company emitted 43.2 kt of sulphur dioxide.

- The report also indicates that the capital budget for the process modifications has been increased to $35 million instead of an earlier projection of $30 million due to some scope changes and further modifications to slag cleaning equipment and operation.

- During 1991, capital projects in the smelter area of about $3.1 million are planned.

- The report states that a more stable black top furnace operation is expected to improve coke utilization and lower overall coke requirements and off-gas cooling needs. Therefore, the company has deferred expenditures of $3 million for two spray coolers pending satisfactory results from the newly developed converter slag cleaning operation.

- The installation of the four large 1350 cu. ft. flotation cells at the company's Strathcona mill is planned for late 1991 and early 1992.

- The report also states that a SO_2 emissions target of 75 kt projected for 1998 may be attainable sooner through further technical and operational developments in the mill and smelter. Laboratory and pilot plant studies are in progress.

The Countdown Technical Support Group (CTSG) concluded that the company's 11th semi-annual progress report met the requirements of the Ontario Regulation 661/85 and that the implementation of the SO_2 abatement program is progressing as per schedule. The CTSG is pleased with the technical progress Falconbridge has achieved in meeting its SO_2 emissions limit of 100 kt three years ahead of schedule. The CTSG is further encouraged to note that the company's July 29, 1991 letter and accompanying progress report indicate that Falconbridge is optimistic of achieving a SO_2 emissions level of 75 kt/yr on a voluntary basis before 1998.

- The CTSG is pleased with the company's reporting format and the level of detail provided in its report.

Some of the points of concern noted by the CTSG are listed below:

- The Ministry is pleased to learn that the company plans to install an analyser to continuously monitor SO_2 concentrations in acid plant tail gases. However, this will not help to identify any process equipment malfunction resulting in excess SO_3 emissions. The reviewers suggest that the company investigate the possible use of an existing automated SO_3 analyser until an accurate and dependable continuous SO_3 monitor becomes available. In the meantime the CTSG recommends that Falconbridge review and possibly increase SO_3 monitoring frequency.

- The proposed changes reported for converter slag treatment/handling in the 11th semi-annual progress report may result in enhanced leaching of heavy metals, including chromium, to area water bodies. Therefore, the CTSG recommends that the company perform leaching tests on slag according to the Ministry's protocols to ensure that changes to the composition of the slag will not have an adverse impact on area water bodies.

- Past progress reports referred to new chemical reagents and new combination of reagents being tested in the mineral separation processes. The CTSG would like the company to obtain appropriate approvals from the MOE before these are introduced as part of the process operation.

- The report indicates that Phase IV of Strathcona Mill modification would cost the company $4.8 million as per Figure 4.1 but no details were provided. The CTSG would like the company to provide details in this area in the next report.

- The process flowsheets and sulphur disposition information provided by the company in this report was very helpful and should be included in the company's future semi-annual progress reports. The CTSG would like to see:
  - the process flowsheets dated to indicate any changes as a function of time, and
  - the sulphur dioxide (SO_2) emissions further broken down to show contributions from the acid plant, smelter and converter aisles.

- The addendum to this report satisfactorily covers the Ministry's concerns raised in earlier Government Review of the Countdown company's progress reports.

ALGOMA STEEL CORPORATION

The Algoma Steel Corporation (ASC) operates an iron ore sinter plant at Wawa, about 270 km northwest of Sault Ste. Marie. Regulation 663/85 limits current SO_2 emissions from the operation to 180 kt per year, dropping to no more than 125 kt per year for every year after 1993.

In August 1986, the sinter production capacity at Wawa was down-sized by about half. When combined with a change to lower sulphur level in feed, this has resulted in much reduced SO_2 emissions.

The company's 11th semi-annual progress report confirms that the company will meet the 1994 SO_2 emission limit by the reduction of sinter capacity. In addition continued use of low sulphur iron oxides at Wawa would further reduce the level of SO_2 discharged from the sinter plant.

The 11th semi-annual progress report also indicates that:

- In the first half of 1991 Algoma's SO_2 emissions were 33.4 kt.
- ASC's earlier forecasts for 1991 indicated that SO_2 emissions would be about 57 kt at a sinter production capacity of 1.22 million tonnes.
- The Countdown Technical Support group concluded that the company continues to meet the requirements of Regulation 663/85.
- A recent news release in the Sault Ste. Marie Star (September 24, 1991) indicates that ASC's new business plan, the Algoma Ore Division operation at Wawa may be shut down between 1991-1996.

ONTARIO HYDRO

Regulation 281/87 requires Ontario Hydro to meet interim 1990 emission limits and imposes a tighter limit for 1994 and beyond. Separate limits are set for SO_2 alone and for the sum of SO_2 plus NO (nitric oxide), as shown in Table 2.

Table 2
Ontario Hydro's Sulphur Dioxide and Acid Gas Emissions Limits

Period	Regulated Limits	
	SO_2	SO_2 + NO
	(kilotonnes per year)	
1986 to 1989	370	430
1990 to 1993	240	280
1994 and future	175	215

The corporation reports that in the first half of 1991 acid gas emissions were estimated at 79.3 kt, and 27.8 kt for SO_2 and NO, respectively. These emissions were 35 percent lower than the total acid gas emissions for the same period in 1990.

The corporation reports expenditures during the first six months of 1991 of $132.8 million on measures contributing to the reduction of acid gas emissions, which included:

- $24.7 million for flue gas desulphurization for the Lambton Thermal Generating Station.
- $14.8 million for flue gas conditioning at the Lambton, Nanticoke, and Lakeview thermal generating stations, required to allow burning of low sulphur coal.
- $0.6 million for combustion process modifications.
- $85.9 million for low sulphur coal premium, which was partially for acid gas control. This is approximately 65% of the total expenditure reported by Hydro for acid gas control in this report.
- $6.0 million for compliance with the emissions verification and reporting order issued by the Ministry in June, 1990.
- $1.8 million for research and development.
- The cost of installation of two flue gas desulphurization scrubbers using a limestone slurry system at Lambton G.S. is estimated to be $537.5 million. These scrubbers are to be in service by 1994.
- The eleventh semi-annual progress report indicates that the flue gas conditioning (FGC) equipment with sulphur trioxide (SO_3) and ammonia (NH_3) conditioning agents has been completed for all units at Lambton and Nanticoke and is working satisfactorily when 0.9% U.S. low sulphur coal is fired. Small decrease in boiler rating when fired with 50/50 blend of U.S. and Canadian Western low sulphur coals is presently being resolved.
- The status of the FGC system at Lakeview TGS has not changed significantly from the 10th semi-annual report. Alternatives to major rehabilitation for units 3, 4, 7, and 8 are presently being addressed.
- In the first half of 1991 Ontario Hydro imported 2.0 TWh (terra-watt hour) of electricity from Canadian and U.S. utilities. This is 77% lower than the electricity purchases made by Ontario Hydro in the same period in 1990 and has resulted in 0.7 TWh of net electricity imports.

Some other points noted by the reviewers are listed below:

- The Countdown Technical Support Group (CTSG) concluded that Ontario Hydro has been meeting the requirements of Regulation 281/87.

- The CTSG was somewhat concerned over the higher reported figure of $537.5 million for Lambton TGS FGD (2 scrubbers) instead of earlier reported estimate of $430 million and would like to receive additional details in this area.

- The CTSG is pleased to note that Hydro's NO_x emissions control plans for Nanticoke and Lambton TG stations include additional combustion modifications which are estimated to further reduce NO_x emissions at these locations by 15 and 30 percent respectively.

- The CTSG group also noted that Ontario Hydro is planning to implement a continuous emissions monitoring program for SO_2 and NO_x emissions for all its fossil fuel fired thermal generating stations at a cost of $19.4 million. When this program is completed and accepted by the Ministry, Hydro would be reporting realtime SO_2/NO_x emissions to the Ministry which can be more easily and independently verified for accuracy.

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